

covery frames. In an embodiment, the combined duration of the time period and the time interval is 15 ms.

[0043] In the passive scanning, the apparatus scans for discovery frames transmitted by access nodes, e.g. OCE-capable access nodes and/or the legacy access nodes. The discovery frames may comprise beacon frames, FILS discovery frames, etc. Upon detecting a discovery frame from an access node in block 404, the process may proceed to block 406 in which the apparatus may determine that it is capable of associating to the access node, and the apparatus may initiate association to the access node. Upon detecting no discovery frame in block 404, the passive scanning for the discovery frames may be continued until the timer is detected to have expired (block 408). Upon expiry of the timer, the apparatus may switch to the active scanning (block 306) and, in an embodiment, cause transmission of a scanning request message such as a probe request message.

[0044] FIG. 5 illustrates a state transition diagram of the apparatus in connection with selecting the network discovery method according to an embodiment of the invention. FIG. 5 illustrates four different states 500, 502, 504, 506 and events causing the switch from one state to another. In state 500, the apparatus performs the initial channel assessment by performing physical carrier sensing according to the embodiment of FIG. 3, for example. In state 502, the apparatus performs the network discovery employing passive scanning functions or active scanning functions such that the use of the active scanning is restricted. For example, the apparatus may be configured to provide at least a minimum delay between transmissions of consecutive scanning request messages. The delay may be 20 ms, for example. In state 504, the apparatus performs active passive scanning functions with the option of using also passive scanning. In state 504, the apparatus may freely choose to use either passive scanning or the active scanning at any time instant. In state 506, the apparatus performs channel assessment according to the passive scanning. State 506 may be performed according to the embodiment of FIG. 4, e.g. by employing the passive scanning for the determined time interval. The state 506 may be considered as a temporary or a short-term passive scanning state. The difference between state 500 and state 506 may be that the state 500 is based only on carrier sensing while the apparatus is configured to detect received frames and extract relevant network discovery information from the received frames. The received frames may comprise at least one of beacon frames, probe response frames transmitted by an access node to another apparatus, and FILS discovery frames. The relevant information may comprise any information element used exclusively by an access node supporting the passive scanning functions only or an information element indicating that an access node transmitting the frame supports the passive scanning functions only. Such an information element may be an OCE-specific information element such as an information element indicating that a transmitter of the frame supports the OCE.

[0045] Let us now describe state transitions according to some embodiments of the invention. When the apparatus has not determined the network discovery method to be used and has not available information on the channel activity, the apparatus may perform the initial channel assessment in state 500. The initial channel assessment may also be used if the information is determined to be outdated due to the time passed from the previous network discovery attempt, or the apparatus has moved a determined distance from the location where the previous network discovery attempt was made, or

according to another criterion. As a consequence, the state 500 may be entered from the state 502 or 504 when the apparatus determines that a new initial channel assessment is needed. The transition from the state 500 to the state 506 may be triggered upon detecting activity on the channel being assessed. The detection may be performed by employing the physical carrier sensing during the above-mentioned time period associated with the duration of the initial channel assessment. If radio energy having reception signal strength exceeding a determined threshold is detected in the state 500, the transition to the state 506 may be triggered. Upon detecting no activity, e.g. no radio energy exceeding the threshold in the state 500, the state transition to state 504 may be triggered.

[0046] Let us now consider the state transition from the state 506. In the state 506, the apparatus attempts to detect a discovery frame according to the passive scanning. Upon detecting such a discovery frame, e.g. within the above-described time interval, the apparatus may trigger state transition to the state 502. On the other hand, upon detecting no discovery frame, e.g. within the above-described time interval, the apparatus may trigger the state transition to the state 504.

[0047] Let us now consider the state transition from the state 504. In the state 504, the apparatus attempts to discover a wireless network by employing both passive and active scanning methods freely. State 504 may be called a legacy discovery mode referring to that it may be designed for detecting the legacy access nodes broadcasting the discovery frames with the lower periodicity. State 502 may be called an OCE discovery mode referring to that it may be designed for detecting the OCE-capable access nodes broadcasting the discovery frames with the higher periodicity. Upon detecting a discovery frame associated with the use of the passive scanning only in the state 504, e.g. a FILS discovery frame indicating the OCE capability of an access node that transmitted the discovery frame, the apparatus may trigger state transition to the state 502 in which the active scanning is more restricted. Upon determining that the information on the channel assessment has been outdated, the apparatus may trigger transition to the state 500.

[0048] With respect to the state 502, upon determining that the information on the channel assessment has been outdated, the apparatus may trigger transition to the state 500. In an embodiment, the apparatus may trigger state transition from the state 506 to the state 504 upon detecting no discovery frame within a determined time duration. The time duration may be longer than the above-described time period and/or the time interval, e.g. 100 ms. As a consequence, the free use of the active scanning methods become available to the apparatus.

[0049] If the apparatus has obtained information on the channel beforehand, e.g. through previous scanning or frame reception, it may start the state machine from the state 504 in case that it knows that no access node transmitting the discovery frames with the higher periodicity is operating on the channel. The apparatus may start from the state 502 in a case where the apparatus knows that an access node transmitting the discovery frames with the higher periodicity is operating on the channel.

[0050] As described above, the apparatus may employ the active scanning in both states 502 and 504. In an embodiment, when the apparatus employs the active scanning in the state 504, the apparatus generates a scanning request message that complies with specifications of the legacy access nodes, e.g.